


Vascular Access Devices: Optimizing Your Choice for Your Patient



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Objectives



- Brief overview of vascular access device(VAD) selection in the ICU
- Explore a clinical scenario highlighting best access choices
- Summary of patient experience

Background

- Millions of vascular access devices are placed each year
- There are many variations of line types
 - PIV, MC, PICC, CICC
 - Lengths
 - Coatings
 - Risks of both placement and insertion
- Choosing Wisely Campaign has targeted correct line choices



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 Chohan, V. et al. "Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) Panel: The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC): Results From a Multiplicity Panel Using the RAND/UCLA Appropriateness Method." *Ann Intern Med* 163.6 (2015): 51-60.

Background

- Several types of non-tunneled lines commonly used in the ICU
 - CICC (insertion sites: internal jugular vein, subclavian vein, femoral vein)
 - PICC (insertion sites: brachial, basilic or cephalic)
 - Midline catheter(MC): (insertion sites: basilic or cephalic)
- Why do we need these lines?
 - Safe, reliable venous access for medications requiring central access, hemodynamic monitoring (central lines only), blood draws

Chohan, V. et al. "Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) Panel: The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) Results From a Multiplicity Panel Using the RAND/UCLA Appropriateness Method." *Ann Intern Med* 163.6 (2015): 51-60.
 Dujovne, Robert P., et al. "Guidelines for the prevention of intravascular catheter-related infections." *Clinical Infectious Diseases* 42.3 (2011): e124-135.
 Dufourcq, Stéphanie, et al. "Quality improvement guidelines for central venous access." *Journal of Vascular and Interventional Radiology* 21.7 (2010): 976-981.






Indications for VAD choices

Why do you need a VAD?

- Medications or nutrition administration
- Hemodynamic monitoring
- Multifactorial needs: hydration, pain management, anesthesia

O'Grady N et al. Guidelines for the prevention of intravascular catheter-related infections. *Clinical Infectious Diseases* 35.11 (2002): 1291-1307.
 Chohan, V. et al. "Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) Panel: The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC): Results From a Multiplicity Panel Using the RAND/UCLA Appropriateness Method." *Ann Intern Med* 163.6 (2015): 51-60.
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WHO needs the VAD?

Consider patient carefully

- ▶ **PATIENT PREFERENCE**
- History of venous thrombosis
- Paresis
- Kidney disease
- Coagulopathy
- Other concurrent medical conditions or needs
 - Recent neck dissection, cervical collar in place, femoral or pelvic trauma

O'Grady N et al. Guidelines for the prevention of intravascular catheter-related infections. Clinical Infectious Diseases 35:11 (2002): 1281-1307.
Chopra V, et al. "Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) Panel: The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) Results From a Multiplicity Panel Using the RAND/UCLA Appropriateness Method." Ann Intern Med 163:6 (2015): 81-90.
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How Long Do You Need It?

BEFORE you place the line, can you approximate how long you might need it?

- 4 - 5 days
- About a week
- Two weeks
- More than two weeks

Chopra V, et al. "Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) Panel: The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) Results From a Multiplicity Panel Using the RAND/UCLA Appropriateness Method." Ann Intern Med 163:6 (2015): 81-90.
O'Grady N et al. Guidelines for the prevention of intravascular catheter-related infections. Clinical infectious diseases 35:11 (2002): 1281-1307.

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How Quickly Do You Need It?

Why do you need a VAD?

- Resuscitation
- Blood draws
- Medication or nutrition administration
- Hemodynamic monitoring
- Multifactorial needs

Chopra V, et al. "Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) Panel: The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) Results From a Multiplicity Panel Using the RAND/UCLA Appropriateness Method." Ann Intern Med 163:6 (2015): 81-90.
O'Grady, Nancy P., et al. "Guidelines for the prevention of intravascular catheter-related infections." Clinical infectious diseases 52:9 (2011): e152-159. *Expert Opinion also

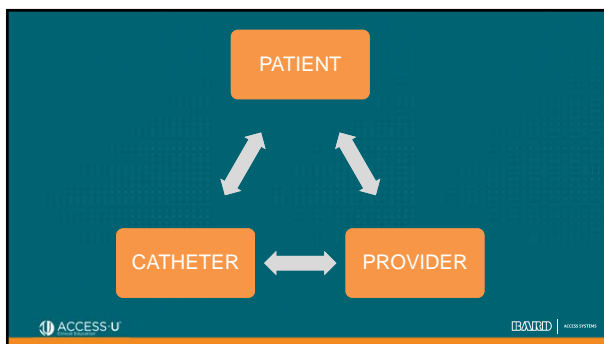
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Slide 9

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Complications of Central Venous Catheterization

<p>IMMEDIATE</p> <ul style="list-style-type: none"> • Bleeding • Arterial puncture • Arrhythmia • Air embolism • Thoracic duct injury (with left SC or left IJ approach) • Catheter malposition • Pneumothorax or hemothorax 	<p>DELAYED</p> <ul style="list-style-type: none"> • Infection • Venous thrombosis, pulmonary emboli • Catheter migration • Catheter Embolization • Myocardial perforation • Nerve injury
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O'Grady, Neumi P., et al. "Guidelines for the prevention of intravascular catheter-related infections." *Clinical infectious diseases* 52.9 (2011): e162-e193.
 Dulavina, Sean R., et al. "Quality improvement guidelines for central venous access." *Journal of Vascular and Interventional Radiology* 21.7 (2010): 976-981.
 Espinola et al. "Pneumothorax as a complication of central venous catheter insertion." *Ann Transl Med* 2015; 3(2): 80.
 Gu X, et al. "Central Venous Access Sites for the Prevention of Venous Thrombosis, Bacteremia and Infection." *The Cochrane Library* 2015.
 Gao, Qinfeng, et al. "Complications with peripherally inserted central catheters (PICCs) used in hospitalized patients and outpatients: a prospective cohort study." *Antimicrobial Resistance & Infection Control* 6.1 (2017).
 Grogan, Paolo, and Mauro Pibou. "Focus on peripherally inserted central catheters in critically ill patients." *World journal of critical care medicine* 3.4 (2014): 80.

Thrombosis

Derived from Baslin et al. Management of occlusion and thrombosis associated with long-term indwelling central venous catheters. *The Lancet*. 2009; 374(9654): 159-169.

Thrombosis

- Catheter associated thrombosis (DVT) is common, with some estimates as high as 75% with a CVAD in the upper torso or extremities
- Multifactorial pathogenesis
- Pulmonary emboli are rare secondary to UEDVT, but symptoms do occur
- DVTs are frequently treated with anticoagulation

Baskin et al. Management of occlusion and thrombosis associated with long-term indwelling central venous catheters. The Lancet. 2009; 374(9644):159-169.
 Barakat et al. Etiopathogenic and Clinical Features of Upper Extremity Deep Venous Thromboses in Critical Care Patients. 2012.
 Ezzawi R et al. Reduction of Peripherally Inserted Central Catheter-Associated DVT. CHEST. 2013; 143(3): 627-633.
 Chrysis V et al. Bloodstream Infection, Venous Thrombosis, and Peripherally Inserted Central Catheters: Reappraising the Evidence. The American Journal of Medicine. 2012; 125: 733-741.

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CLABSI

Baldar N et al. The pathogenesis of catheter-related bloodstream infection with noncuffed short-term central venous catheters. Intensive care medicine. 2004; 30(1): 62-67.

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CLABSI

- Definition: laboratory-confirmed bloodstream infection where:
 - Central line (CL) was in place for >2 calendar days and
 - The blood culture is positive while line is present or within 1 day of removal

AND

 - Bloodstream infection is not due to a clear secondary cause
- CICC vs PICC vs Midline vs PIV
 - Is one really better?




O'grady, Nicolle P., et al. "Guidelines for the prevention of intravascular catheter-related infections." Clinical infectious diseases 52.9 (2011): e162-e193.

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Importance

- Patient outcomes
- DVT and CLABSI lead to increased LOS
- Significant attributable increased costs
- Reimbursement losses for "preventable" CLABSI
- Hospital rankings, physician accountability




Zimlichman, Eyal, et al. "Health care-associated infections: a meta-analysis of costs and financial impact on the US health care system." *JAMA Internal Medicine* 173.22 (2013): 2039-2046.
Evans R, et al. Reduction of Peripherally Inserted Central Catheter-Associated DVT. *CHEST*. 2013 143(3): 627-633.

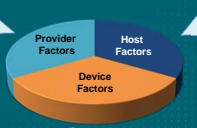
Prevention

- Limited evidence on choosing CICC vs PICC vs midline
- Thoughtful Patient and Line/Lumen Selection
 - Weigh risks of infection, thrombus, other complications
- "Bundles"
 - VTE
 - CICC, PICC and midline insertion
- Prompt line removal
- Education
 - Hospitalist survey by Chopra et al in 2013: 1/3 examine lines, > 50% have forgotten PICC lines were present, approximately 47% also indicated that 10-25% of PICCs are inappropriately placed at times, few know why tip verification is important

Chopra, V, et al. "Hospitalist experience, practice options, and knowledge regarding peripherally inserted central catheters: a Michigan survey." *Journal of Hospital Medicine* 8.8 (2013): 309-314.
O'grady, Nancy P, et al. "Guidelines for the prevention of intravascular catheter-related infections." *Clinical infectious diseases* 52.2 (2011): 1-23.
Paine et al. Does My Patient Still Need This Central Venous Catheter? A Teachable Moment. *JAMA* 2014. 14(11):1725-4.e1624-193.

Prevention Factors



BSI Prevention:
Care During Insertion
Care During Access
Vigilance for Complications
Early Discontinuation

VTE Prevention:
Prophylactic Anticoagulants
Verify Tip Location
Minimize Insertion Attempts




BSI Prevention:
Critical Illness Status
Hospitalized Status
Concurrent Bacteremia
Number of Prior Line Insertions

VTE Prevention:
Avoid PICC if history of prior VTE
Avoid PICC if cancer history
Avoid PICC if surgery > 1 hr planned

BSI Prevention:
Limit Number of Lumens
Consider Antimicrobial Catheters
Early Removal of PICC Lines

VTE Prevention:
Avoid Large Diameter PICCs/extra lumens
Verify Location at Cavofistular Junction
Use Right-Sided Approach

Adapted and expanded from Chopra, V et al. Bloodstream Infection, Venous Thrombosis, and Peripherally Inserted Central Catheters: Reappraising the Evidence. *The American Journal of Medicine*. 2012; 125: 129-141.
Carpney, Paolo, and Mauro Pitolis. "Focus on peripherally inserted central catheters in critically ill patients." *World journal of critical care medicine* 3.4 (2014): 80.
Evans R, et al. "Guidelines for the prevention of intravascular catheter-related infections." *Clinical Infectious Diseases* 52.2 (2011): 1-23.
Paine et al. Does My Patient Still Need This Central Venous Catheter? A Teachable Moment. *JAMA* 2014. 14(11):1725-4.e1624-193.

Infection Prevention Guidelines

Education & Training: Educate healthcare personnel regarding the indications for intravascular catheter use, proper procedures for the insertion and maintenance of intravascular catheters, and appropriate infection control measures to prevent intravascular catheter-related infections.

Hand Hygiene & Aseptic Technique: Perform hand hygiene procedures, either by washing hands with conventional soap and water or with alcohol-based hand rubs (ABHR). Hand hygiene should be performed before and after palpating catheter insertion sites as well as before and after inserting, replacing, accessing, repairing, or dressing an intravascular catheter. Palpation of the insertion site should not be performed after the application of antibiotic, unless aseptic technique is maintained.

Maximal Sterile Barrier Precautions: Use maximal sterile barrier precautions, including the use of a cap, mask, sterile gown, sterile gloves, and a sterile full body drape, for the insertion of CVCs, PICCs, or guidewire exchange.

Skin Preparation: Prepare clean skin with a 0.5% chlorhexidine preparation with alcohol before central venous catheter and peripheral arterial catheter insertion and during dressing changes. If there is a contraindication to chlorhexidine, tincture of iodine, an iodophor, or 70% alcohol can be used as alternatives.



Catheter Site Dressing Regimens: Use either sterile gauze or sterile, transparent, semi-permeable dressing to cover the catheter site. If the patient is diaphoretic or if the site is bleeding or oozing, use a gauze dressing until this is resolved. Replace catheter site dressing if the dressing becomes damp, loosened, or visibly soiled.

Catheter Securement Devices: Use a suture-less securement device to reduce the risk of infection for intravascular catheters.

Replacement of CVCs, Including PICCs & Hemodialysis Catheters: Do not routinely replace CVCs, PICCs, hemodialysis catheters, or pulmonary artery catheters to prevent catheter-related infections.

Replacement of Administration Sets: In patients not receiving blood, blood products or fat emulsions, replace administration sets that are continuously used, including secondary sets and add-on devices, no more frequently than at 96-hour intervals, but at least every 7 days.

Opriely, Naimi R., et al. "Guidelines for the prevention of intravascular catheter-related infections." *Clinical infectious diseases* 52.9 (2011).

Research Review and the Why?



- Provide the best line for the patient WHILE minimizing risk
- Decrease risks of infection and thrombosis
- Decrease patient morbidity and mortality
- Decrease financial repercussions of line-related complications
- Increase patient satisfaction and cost savings

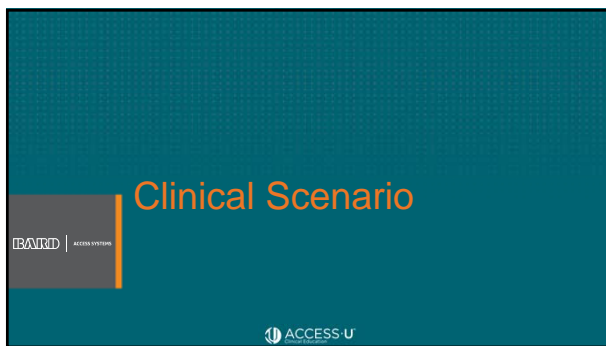
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What About Midlines?

- Midlines provide longer duration of available access than a PIV but do not achieve central access
- May be associated with less thrombosis and CLABSI; but also may be under-reported as midline CLABSIs are not currently reportable. Complications remain controversial surrounding MC use.
- Commonly considered in difficult access cases (at least 2-3 failed IV attempts, or if duration of therapy is >5-6 days)
- In limited literature, lower rates of phlebitis have been reported compared to PIVs

Xu, Tianyuan, et al. "Safety and utilization of peripherally inserted central catheters versus midline catheters at a large academic medical center." *American journal of infection control* 44.12 (2015): 1458-1461.
Rooney, Henry, Gordon Spill, and Margaret Hill. "How to establish an effective midline program: a case study of 2 hospitals." *Journal of the Association for Vascular Access* 20.3 (2015): 179-185.

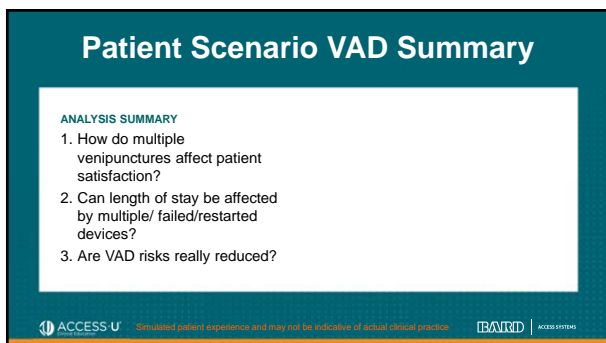





Clinical Scenario

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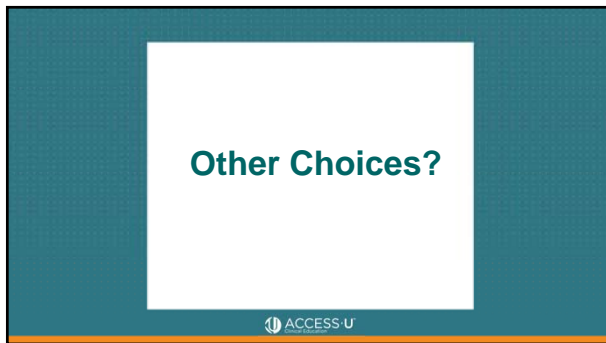


Patient Scenario VAD Summary

ANALYSIS SUMMARY

1. How do multiple venipunctures affect patient satisfaction?
2. Can length of stay be affected by multiple/ failed/restarted devices?
3. Are VAD risks really reduced?

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Other Choices?

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What Could Have Been Considered?

- Need for known multiple blood draws with heparin, vancomycin and operative management
- What the anticipated long-term care plan would be (> 14 days of IV antibiotics)?
- Patient Satisfaction

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Future Directions

- Scoring system for risk of complications for lines are being developed but not widely accepted
- New technology for line placement and of lines themselves
- Further prospective studies comparing multiple VAD sites with complications rates
- ?, if CLABSI type definition/penalty will start to include midlines

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Take-Home Points

- Clinicians need to understand potential complications of CVADs, including CICC, PICCs & MCs
 - There is a role for all of these lines
- Indications for VAD and duration of need must be considered & considered early
- Complications impact patient outcomes, reimbursements and ranking
- Further research into best practices for CVADs are need given the evolving technology and clinical utilization
 - Until then; choose the line that is best for your patient

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